REPORT

HYDROGEOLOGIC ASSESSMENT OF THE ALLIED WASTE BEDS IN THE SYRACUSE AREA

VOLUME 1 OF 2

Allied-Signal, Inc.

Solvay, New York

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BLASLAND & BOUCK ENGINEERS, P.C.
BLASLAND, BOUCK & LEE
ENGINEERS & GEOSCIENTISTS

of calcium carbonate, calcium silicate, and magnesium hydroxide with small amounts of carbonates, sulfates, salts and metal oxides. These wastes were disposed in the waste beds as a slurry comprised approximately of 5 to 10 percent solids. The solids were allowed to settle out in the waste beds, and the slurry water was removed by evaporation or decanted by drainage systems.

Site reconnaissance and, to a limited extent, water quality sampling activities were performed for all waste bed and suspected disposal areas. However, the main focus of the field investigation program was by in large, the more recently active waste beds in the Nine Mile Creek Valley.

Based on a review of available historic information and site reconnaissance, it does not appear that significant volumes of Solvay Waste were placed in areas southeast of Hiawatha Boulevard. Area L, along Ley Creek, has reportedly received trash, and construction and demolition materials, but there is no verification that Solvay Waste was placed in this area.

No indication of Solvay Waste was observed or recorded for the Onondaga Lakefront (OLF) areas on the northeast and southwest sides of the lake. Natural salt springs have been reported along the northeast OLF, which fed "salty ponds" along Onondaga Lake Parkway.

During the last 19 years, Nine Mile Creek has been periodically monitored by other parties. This monitoring has indicated that Nine Mile Creek has been a significant contributor of chlorides to Onondaga Lake. Sampling performed as part of this investigation indicates that ground water is a significant source of chloride contribution to Nine Mile Creek.

Waste Beds 1-8 were recipients of Solvay Wastes from approximately 1916 to possibly as late as 1950. This group of Beds has had other waste placed on it by another industry in the late 1970's and 1980's. A good deal of information exists on the other waste activities for these Beds, but little exists concerning the deposition of Solvay Waste.

Waste Beds A-E as a group were active in receiving Solvay Waste from approximately 1889 to 1926. In addition, Bed A was used from approximately 1920 to 1970 for the disposal of Semet Solvay tar wastes which were placed on top of Solvay Waste. Bed B was engineered for receiving Solvay Waste by constructing a bulkhead into Onondaga Lake. Sewer sludge was placed in trenches on Bed B by the City of Syracuse. Limited data are available on Waste Beds A-E.

Little data are available on Areas F-M and OLF in comparison to the amount of information available for the other waste beds. These areas (and suspected areas) were the first to receive Solvay Waste, with documentation existing back to 1892. In general, these areas became inactive between 1926 to 1930. These older beds have had the greatest change in land use of any of the other waste beds. The area designated as OLF is classified as a suspected fill area.

2.4 Solvay Process Waste Characteristics

The chemical and physical characteristics of the Solvay Waste material found in the beds are a function of: 1) the manufacturing process from which the waste was produced; 2) other wastes which may have been placed concurrently with the Solvay Wastes (e.g. fly and bottom ash); 3) the age,

Syracuse Works. Because high salinity brine was needed as part of the Solvay Process, wells were drilled to over 1,000 feet deep in areas south of Syracuse to obtain brine from rock salt deposits. Numerous wells were drilled in the Syracuse area from 1881 until 1888, when rock salt was finally encountered at a depth of 1216 feet in the center of the Tully Valley. In the 1880's, the salt industry began to decline because of the expense of drilling to obtain rock salt and the discovery of more readily available and more abundant sources of salt in Michigan, Ohio and Virginia. During the period of 1797-1904, roughly 430,000,000 bushels (over 12,000,000 tons) of salt were produced around Onondaga Lake. In 1908, the State terminated its long-established interest in the well at the south end of the lake and the salt industry in the Onondaga Salt Reservation had virtually ended by this time. However, as the salt industry declined, other industries continued to grow.

As more and more industrial and residential areas were built around the lake, the swamps and wet lands were drained and filled, and land came under cultivation. These land-use changes which occurred at waste bed locations and suspected waste disposal areas will be discussed for each waste bed or waste disposal area. Table 4 presents a list of the present owners of Waste Beds 1-15 and A-E and possible Waste Disposal Areas F-M.

3.2 History of Areas F through M and OLF

Areas F through M and the OLF parcels are included as areas that may have received Solvay Waste, as indicated in the Consent Order. Due to the length of time since the possible deposition and the amount of development

in the area it is not possible, based on the information available, to delineate the exact location and thickness of waste in these areas.

These areas, which are shown on Figure 1, are located at the southeast end of Onondaga Lake, except for Area L, which is located along both sides of Ley Creek near the point where the creek enters Onondaga Lake.

These eight areas comprise some 910 acres or roughly 1.4 square miles, much of which was originally swampy lowlands (Babcock, 1854). When the lake level was lowered in 1822, a zone along the lake's edge, in places as much as 800 feet wide, was reclaimed from the lake. Between 1854 and 1860, Geddes Road was constructed across the area in the approximate location of Hiawatha Boulevard. Between 1860 and 1874, railroad tracks of the Syracuse Junction Railroad were built along the southeast end of the lake in the approximate current location of the Conrail tracks. At the lake's southern extreme, the railroad embankment cut across a small area of the lake which was filled between 1892 and 1908. The Barge Canal at the southeast end of the lake was constructed prior to 1892, and this resulted in the rerouting of the northern portion of the inflowing Onondaga Creek which originally flowed into the lake further to the northeast. The portion of Onondaga Creek channel that was cut off apparently remained in existence as late as 1908 (Dawson, 1860; Walker, 1874; Vose, 1892; USGS, 1923; Hopkins, 1908).

Early industrial activity in this area was dominated by the production of salt. Numerous salt sheds were located to the southeast of Geddes Road (Hiawatha Boulevard), on both sides of Ley Creek, and along the lakeshore northwest of Ley Creek (USGS, 1923). However, by 1926, most of the salt sheds were apparently in disuse, or had been removed (Airmap, 1926) due

to the decline of the industry in the Syracuse area. With the completion of the barge canal terminal in Area M, storage of petroleum products became important in the area, principally in the vicinity of Area K and to a lesser extent Areas H and J.

Other former industrial activity in the area included: the General Chemical Company's Syracuse Works (Area K), Syracuse Reduction and Manufacturing (a fertilizer producer) in Area G, both in existence by 1926; a water gas plant located in Area G, in existence from sometime before 1926 until before 1966; the Syracuse Garbage Reduction Plant (Area G) and the Syracuse Sewage disposal facility, in existence before 1938 to the present (now Metro). Industrial facilities currently located in the area, in addition to the oil storage facilities in 'Oil City' and the Metro Plant include: the city regional markets (Area L); Will and Baumer, Candle Manufacturer (northwest portion of Area L); an auto recycling facility (Area H); and a cement plant (Area H).

Filling history in this area probably began sometime shortly after the Onondaga Lake level was lowered in the early 1800's. The first historical indication that Solvay Waste had been used as fill material is shown on a 1908 map which delineated an area east of Iron Pier Park, in Area H on the lakefront, as having been filled with "soda ash refuse." The Solvay Process Company also owned property at that time in Areas F and G, part of which is now occupied by the Metro Plant. Borings conducted for design of the Metro Plant indicate that there is discontinuous and variable thicknesses of Solvay Waste fill under the site ranging from 0 feet to more than 15 feet.

Review of historical air photos shows several areas where light-colored fill materials have been deposited. In 1926 photos, large portions of Areas

F and G are covered with what appears to be Solvay Waste, and this is substantiated by the borings for the Metro Plant. In addition, a relatively small area along the southeast side of Hiawatha Boulevard in Area J appears to be receiving Solvay Waste. At the same time, a large circular area in the center of Area H and a narrow zone along the northwest side of Hiawatha Boulevard, also in Area H, appears to be filled with a light-colored material.

The 1938 aerial photos do not show the same pattern of filling as the 1926 photos. In the 1938 photos, both Areas G and J appear to be receiving "hard" fill materials (fill which is not placed hydraulically as a slurry) of variable texture, and the light-colored fill in Area F is darker, possibly indicating inactivity. The large circular area in the center of Area H is lower than the surrounding area and may have contained standing water. Between 1951 and 1959, this depressed area was filled with hard fill materials. Hard fill was placed in the southeast portion of Area L sometime prior to 1959, possibly in association with the construction of Interstate 81. This area of hard fill was greatly expanded towards the northeast in Area L by 1966. A portion of this hard fill may possibly be refuse that had been landfilled by Onondaga County during this period (Allied communication). This area appears on aerial photographs to be mostly revegetated by 1978.

Based on the historical information and aerial photos reviewed, a number of the areas at the southwest end of Onondaga Lake do not appear to have been used for deposition of Solvay Wastes. These include Areas I, K, L, M, OLF and most of J except for a narrow zone along the southeast side of Hiawatha Boulevard as previously mentioned. Small amounts of "chemical waste" had been reported to be present in the borings conducted

for I-81 in Area K; however, the material in these locations appears to be laterally discontinuous. Based on this information, it is thought that the "chemical waste" is there as a result of hard fill placement in association with road construction activities and not as a result of disposal by the Solvay Process Company, or Allied.

Historical information indicates that the Onondaga Lakefront (OLF) on the northeast side of the lake was the location of the Oswego Canal as early as 1854 (Babcock, 1854; Walker, 1874). The canal was present up through 1898 (USGS, 1923). The area occupied by the canal was, in part, replaced by roads and railroads by 1926 (Airmap, 1926) and the Onondaga Lake Park by 1939 (USGS, 1939). Further road development, particularly toward the southeast, with the construction of I-81 prior to 1958, occupied more of the lakefront area.

Activity on the southwestern OLF includes several beaches towards the northwest end (Maple, Rockaway, Manhattan and Pleasant Beaches) by 1898. Apparently, little activity occurred in this area during 1938 through 1958 (USDA, 1938; USGS, 1939; USGS, 1958). Dredging of the lake bottom off the point where Nine Mile Creek enters the lake reportedly occurred sometime during the late 1960's. The dredged materials were placed behind a bulkhead along the shoreline to create an Onondaga Lake Park along this portion of the shore by 1973 (USGS, 1978).

4.2 Site Reconnaissance

A field reconnaissance of the site was conducted during the end of April and early May 1987. Observations pertaining to general vegetation cover, buildings, roads, surface conditions, seeps, springs and surface water bodies were made during the reconnaissance. All observations were noted in a bound field book and referenced to station numbers located on low level aerial photographs taken in 1981. A summary of the observations is given in Figures 3 through 6. A general review of the reconnaissance, on an area by area basis, follows:

4.2.1 Areas F-M and OLF

Areas F-K and M are located at the southeast end of Onondaga Lake. Areas F, G and H are along the lakeshore. Area L is the low area along either side of Ley Creek from the lakeshore to Seventh North Street. The OLF, or Onondaga Lakefront, extends along the northeast and southwest lakeshore. Observation stations are summarized in Figures 3 and 4.

The area encompassing Areas F-K and M is developed with industrial, commercial and a limited amount of residential properties. "Oil City" is located in the vicinity of Areas H, J and K, which also includes Marley's scrap yard. The proposed site of Pyramid's Carousel Project is situated in Area H, and numerous industrial facilities including a pavement materials plant, are situated in Area J. Most of the property in these areas is privately held and access for the purpose of this investigation was limited. Surface drainage is controlled by a

storm water drain system along the roadways. Neither seeps or springs were observed in the area.

Shallow hand-dug excavations were made in Areas G, J and I, and Solvay Waste was observed only in Area G at a point along the canal. An exposure along the northeast side of the canal revealed an area of white material. This information, in conjunction with historical data, substantiates the presence of Solvay material in the areas fronting Onondaga Lake. No white material or Solvay Waste was observed along the banks of the canal southeast of Hiawatha Boulevard in areas where the protective rip-rap was missing. The absence of Solvay Waste in a particular area is harder to document than the presence of this material; however, it appears that no significant volume of Solvay Waste was placed in Areas I, J, K or M, based on the reconnaissance observations or historical data.

Observations made during a reconnaissance of the Ley Creek Area (L) indicated that extensive dumping of construction and demolition debris had recently occurred in this area. Numerous piles of siding, blacktop, and concrete rubble, shingles, etc., were observed. Vegetative growth was moderately well-developed in this area with cobbles and gravel exposed at the ground surface, along with concrete rubble and brick. A steep bank along the northwest side of Ley Creek, approximately 8 feet high, exposed concrete and brick rubble. Based on this information, it appears that Area L has been used as a construction and demolition disposal area for some time.

Low swales on the ground surface contained some standing and running water. One southwest-northeast trending swale, roughly

paralleled a dirt "track" that crosses the area. A pH of 7.4 and a specific conductance of 390 micromhos per centimeter (umhos/cm) was observed at this location. Ley Creek, near the U.S. Geological Survey (USGS) Stream Gaging Station, had a pH of 6.7 with a specific conductance of 850 umhos/cm. These values are markedly lower than the pH and specific conductance values noted in areas where Solvay Waste have been deposited more recently. If Solvay Waste is present in this area, it is likely that it is an insignificant volume of material.

Observations of the OLF Areas indicate that the northeast OLF has been strongly impacted by cultural activities. Several small ponds are located near the southeast end of the area, apparently fed by runoff and seeps. One seep with an estimated flow of 5 gallons per minute (gpm) fed a pond northwest of Route 57. This seep had a pH of 7.1 and a specific conductance of 1,787 umhos/cm.

Shallow excavations along the beach of the southwest OLF revealed only marl, typically fossil-rich, with occasional concretions. One excavation did find peat underlying the marl. A culvert pipe, draining an area along the Interstate, had surface water with a pH of 7.9 and a specific conductance of 630 umhos/cm. No indication of Solvay Wastes was observed in either of the OLF Areas.

4.2.2 Waste Beds A-E

These beds are located southeast of Beds 1-8 along a relatively narrow strip on both sides of I-690 extending to Hiawatha Boulevard and totalling approximately 130 acres. The limits of Beds C-E have been obscured by cultural development in this area; however, the

concentrations of chloride, calcium and sodium are shown in Figure 21.

Onondaga Creek, which flows from south to north through the Onondaga Valley and the City of Syracuse, drains a watershed of approximately 102.5 square miles and has an average annual flow rate of 193.6 cfs before it discharges to the south end of Onondaga Lake at the Barge Canal terminal area. The creek has been relocated from its former discharge point which was located at the southeast corner of Onondaga Lake. At its current location, it flows past suspected Waste Bed Areas G, H, J, K and M. The New York State Water Quality Classification for this stretch of Onondaga Creek is Class D. Stream flow data for Onondaga Creek are presented in Table 10. Average water quality values for concentration and loading rates of chlorides, calcium and sodium are presented in Table 11. Average flow and concentrations for chlorides, calcium and sodium are shown in Figure 22.

Ley Creek drains an area of approximately 26.2 square miles east of Onondaga Lake before discharging to the southeast corner of the lake at an average annual flow rate of 45.3 cfs. This creek, below its junction with Beartrap Creek, is currently classified as Class D under the New York State Water Quality Classification system. In its lower reaches, southwest of Seventh North Street, it flows through suspected Waste Bed Area L. Stream flow data for Ley Creek are presented in Table 12. Average water quality values for concentration and loading rates

of chlorides, calcium and sodium are presented in Table 13. Average stream flow and concentrations of chlorides, calcium and sodium are shown on Figure 23.

The Metro Plant is located at the south end of Onondaga Lake west of Onondaga Creek. The Metro Plant contributes a percentage of flow and ionic loading to Onondaga Lake. However, as previously discussed, a percentage of this flow and ionic loading discharged to the lake is attributable to Allied's Waste Beds 12-15 area. This will be further expanded in subsequent sections of the report. Average discharge rates, water quality values for concentration, and loading rates for chloride, calcium and sodium are presented in Table 14. Average discharge rate and concentration of chlorides, calcium and sodium are shown on Figure 24.

4.3.2.2 Precipitation and Water Balance

Current hydraulic loading of the waste beds is significantly less than the loading during Allied's full-scale operations (until 1985). With the exception of past wastewater discharge from LCP (at an average 1987 daily rate of approximately 164,000 gallons per day to Waste Bed 14), loading to ground water beneath the beds results from infiltration of rainfall and dewatering of pore space in the newer beds. The volume of leachate generated from a given waste bed is therefore proportional to the amount of infiltration that enters the waste bed and function of the age of

TABLE 3

WASTE BED AREA AND THICKNESS AND
VOLUME OF SOLVAY PROCESS WASTE

	Area*	Thickness	Volume
A	1.67 x 10^6 ft^2 38.3 acres	30 ft(a)	50.1 x 10^6 ft^3 1.86 x 10^6 yd^3
B	1.21 x 10^6 ft^2(b) 27.8 acres	17 ft(c)	20.6 x 10^6 ft^3 0.76 x 10^6 yds^3
C	0.95 x 10^6 ft^2 21.8 acres	(d)	?
D	0.918 x 10^6 ft^2 21.1 acres	(d)	?
E	0.995 x 10^6 ft^2 22.8 acres	(d)	?
F	1.36 x 10^6 ft^2 31.2 acres	(d)	?
G	2.96 x 10^6 ft^2 68.0 acres	6 ft(e)	17.7 x 10^6 ft^3 0.66 x 10^6 yd^3
H	6.08 x 10^6 ft^2 139.6 acres	(d)	?
I	3.34 x 10^6 ft^2 76.7 acres	(f)	--
J	4.48 x 10^6 ft^2 102.9 acres	(g)	?
K	5.96 x 10^6 ft^2 136.8 acres	(f)	--
L	10.68 x 10^6 ft^2 245.2 acres	(f)	--
M	4.80 x 10^6 ft^2 110.2 acres	(f)	--
1-8	13.4 x 10^6 ft^2(h) 314.5 acres	67 to 20 ft	685.0 x 10^6 ft^3 25.4 x 10^6 yd^3
9-10	3.2 x 10^6 ft^2 73.5 acres	70 ft	224.0 x 10^6 ft^3 8.30 x 10^6 yd^3

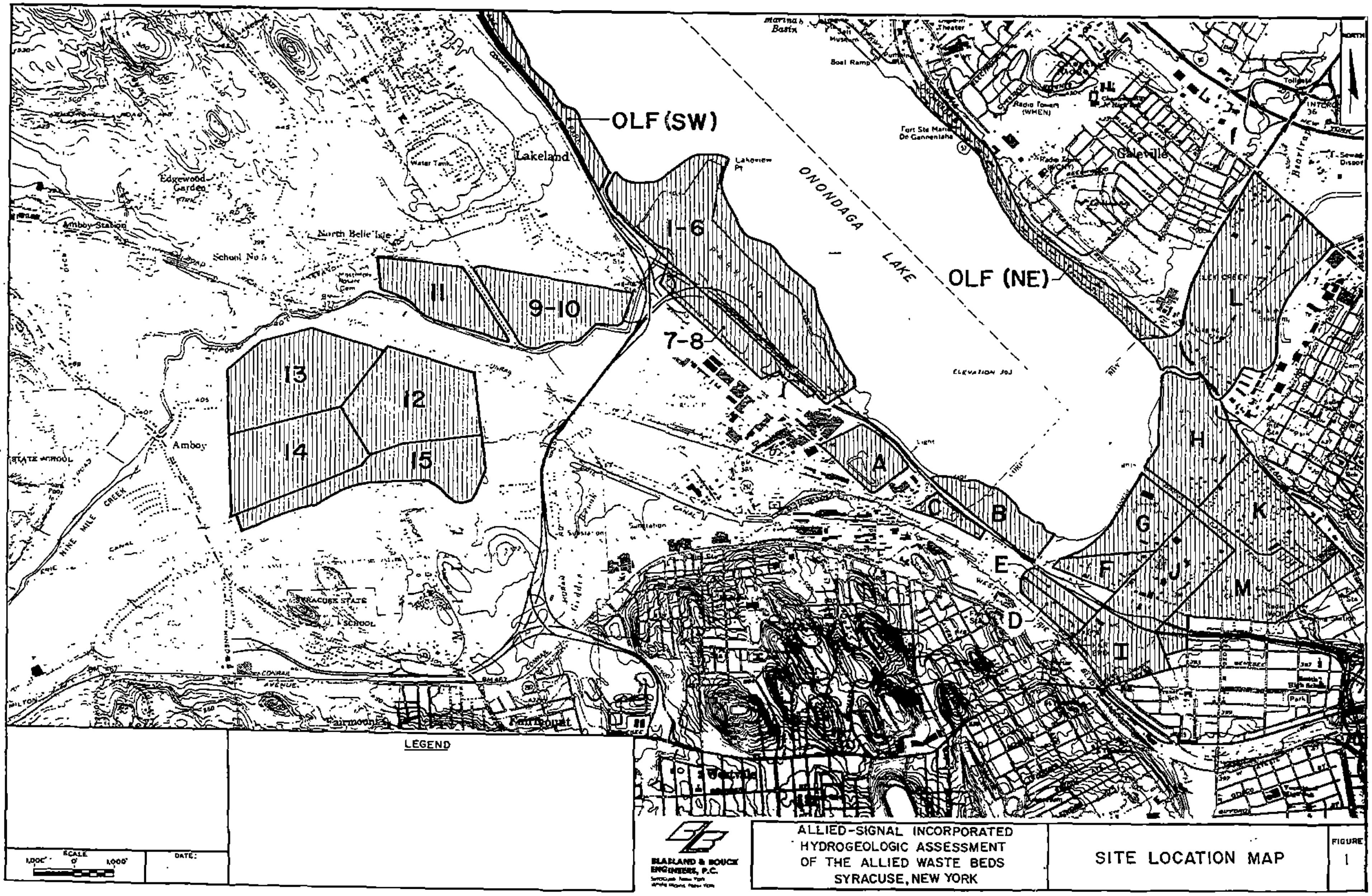
TABLE 12

LEY CREEK AT PARK STREET

FLOW (CFS)

Year	Mean	Max.	Min.
1973	51.2	350	9.0
1974	50.8	514	10.0
1975	51.8	831	11.0
1976	59.7	602	5.6
1977	46.0	546	1.9
1978	69.8	631	8.5
1979	35.5	270	9.9
1980	29.2	660	5.2
1981	26.1	328	6.1
1982	44.0	748	5.9
1983	42.4	686	5.2
1984	46.8	580	7.1
1985	35.3	340	5.2
1986	45.0	423	6.5
1987	____		6.8
Average	45.26		

Source: USGS



LEGEND

SCALE 1,000' 0' 1,000'

DATE:

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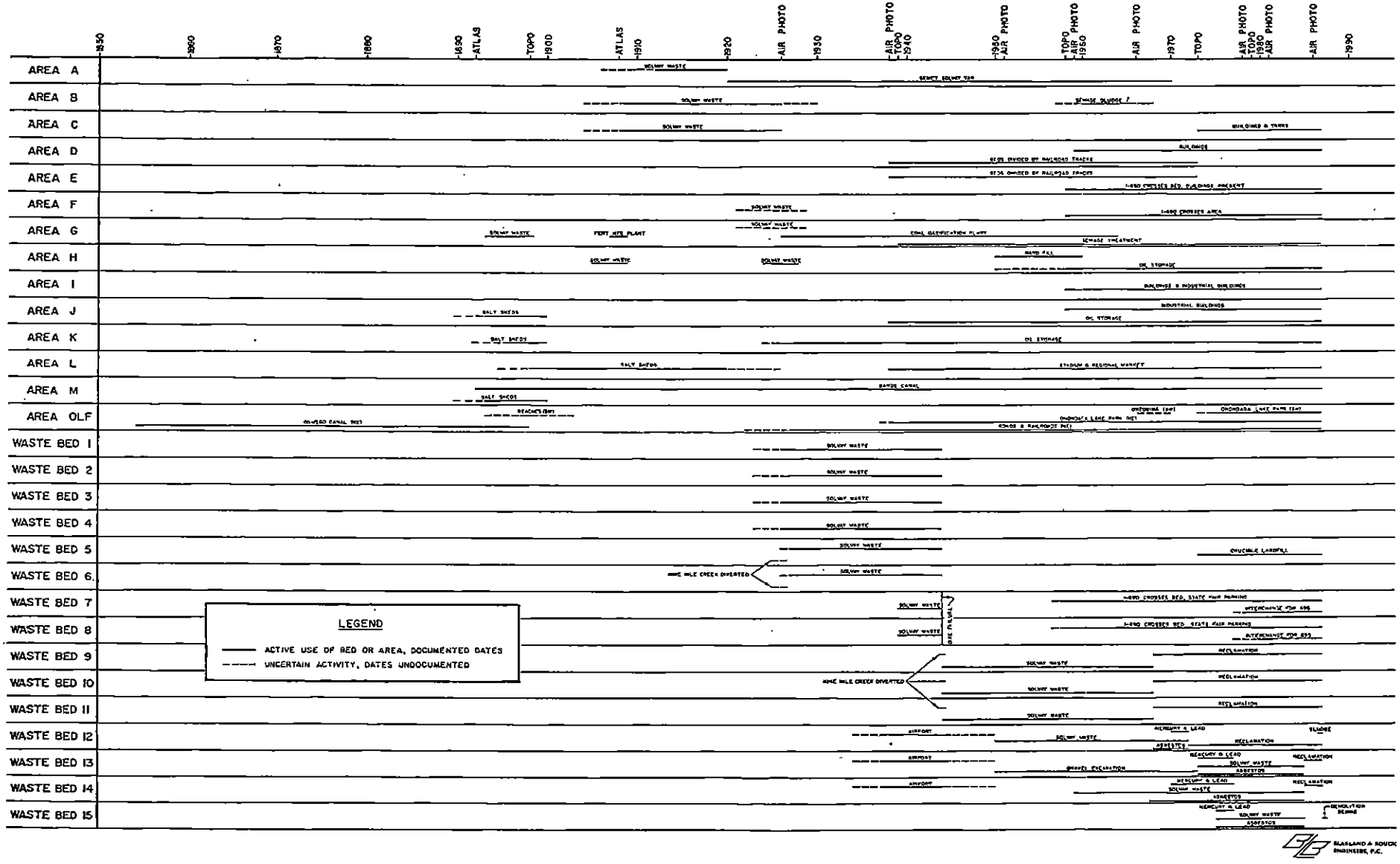
SITE LOCATION MAP

FIGURE 1

CHRONOLOGY OF WASTE DISPOSAL AREA UTILIZATION

FIGURE 2

ALLIED CORPORATION
SOLVAY, NEW YORK



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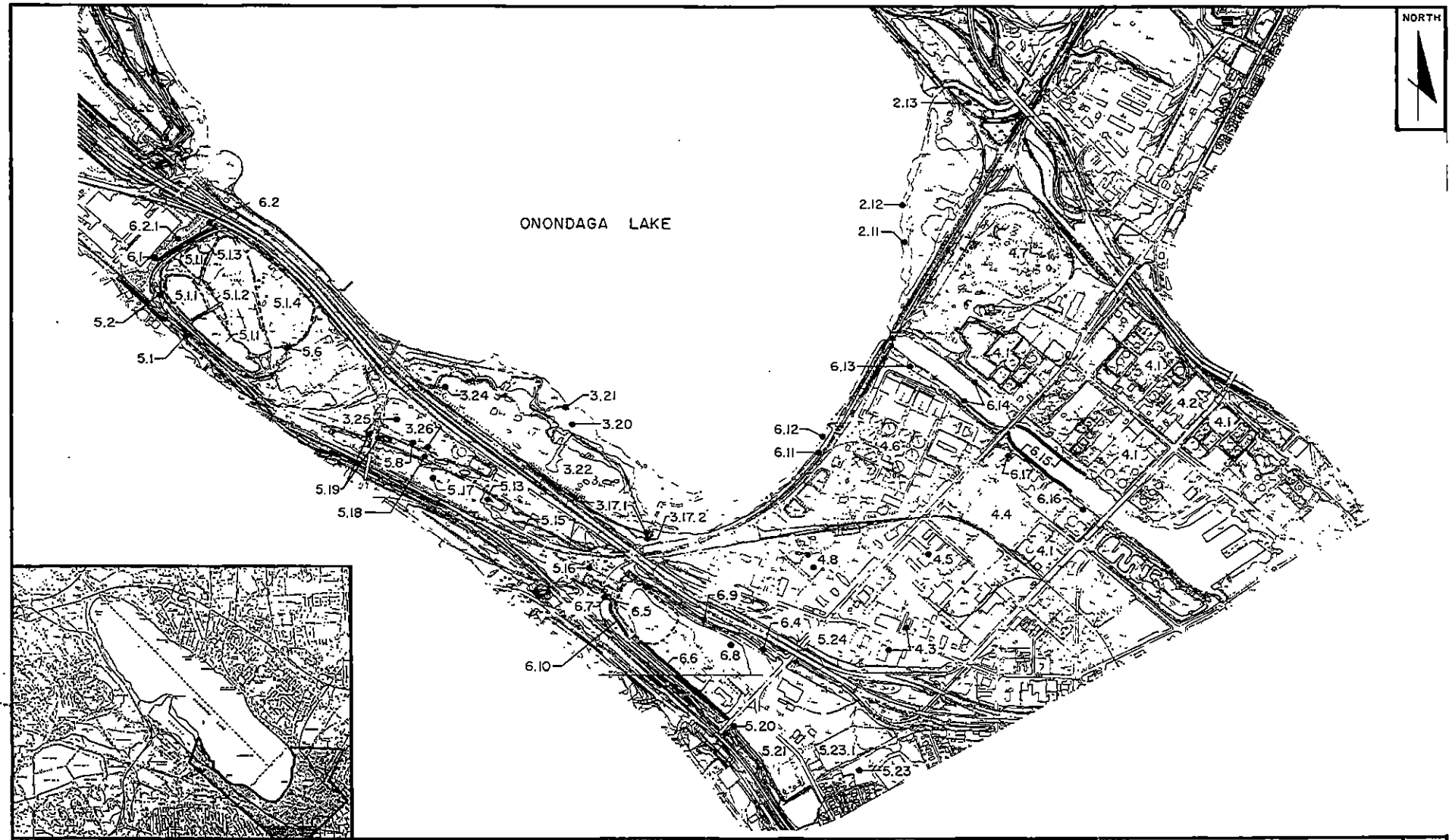

DATE:

SCALE: 1,000' 0 1,000'

5.23 Observation station and number, see attached sheets for explanation. Site observations made during walkovers of May 1-6, 1987.

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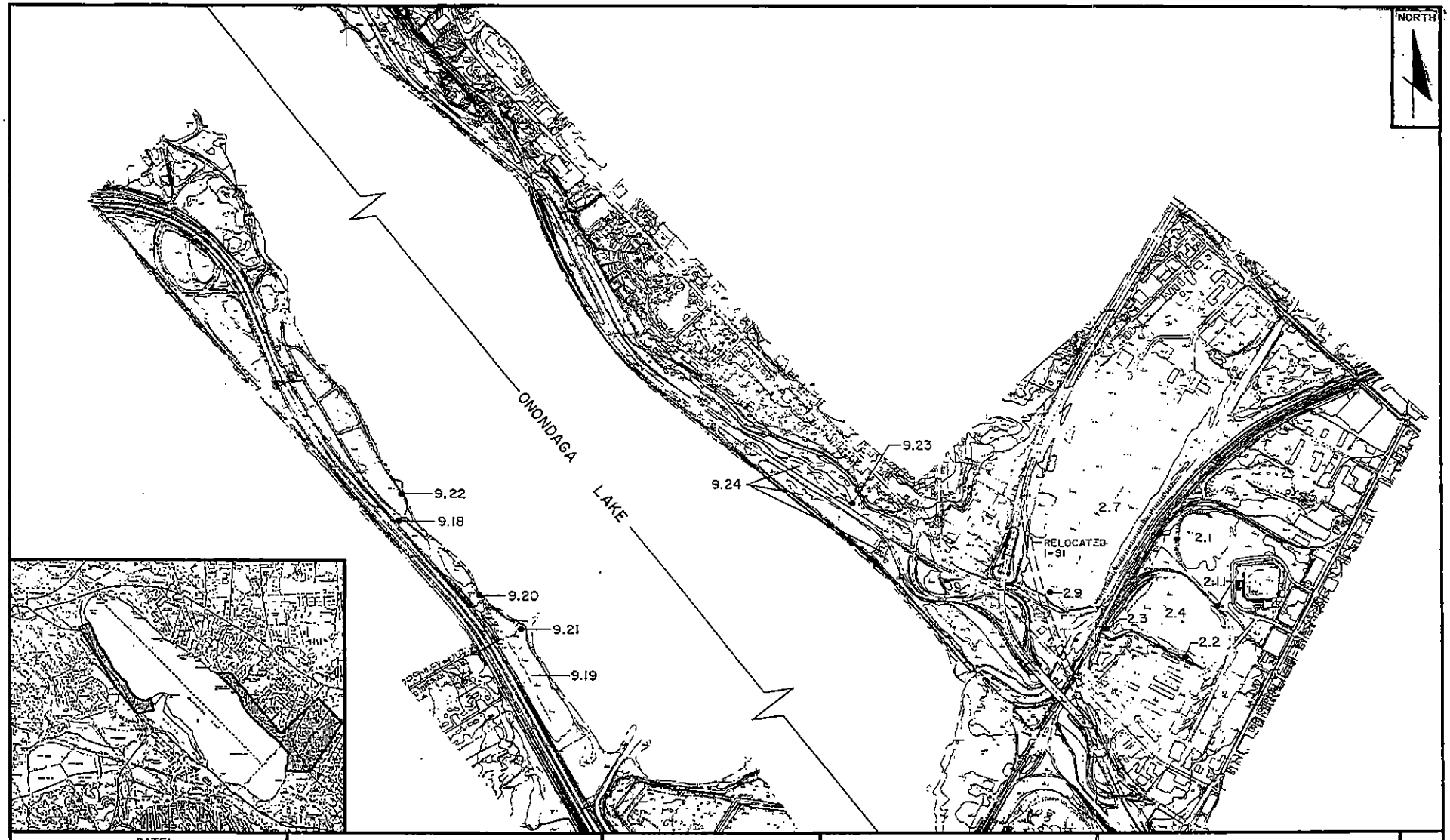
WASTE BEDS A-E AND AREAS F-K & M SITE OBSERVATIONS

FIGURE 3



DATE:

SCALE: 1,000' 0 1,000'

2.12 Observation station and number, see attached sheets for explanation. Site observations made during walkovers of April 29, 1987.

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AREAS L AND OLF
SITE OBSERVATIONS

FIGURE 4

SITE OBSERVATIONS MADE DURING SITE RECONNAISSANCE OF APRIL 29, 1987

AREAS L AND OLF

2.1 Open, uneven lot with poor to fair grass cover. Fill slope 3+ feet high along west and north sides of lot. Fill composed of concrete rubble, gravel, wood and metal. Water sample from base of fill in swampy area that extends to railroad tracks to the west. pH - 7.0, SC - 800.

2.1.1 Sample from drainage swale. pH - 6.7, SC - 1,200.

2.2 Drainage swale in Regional Market area, observed hard fill in southwestern face of swale. pH - 6.7, SC - 700.

2.3 Drainage swale draining southwest. pH - 7.2, SC - 1,700.

2.4 Heavy cover of "reed grass" area appears to be fill with metal and concrete commonly observed at ground surface.

2.7 Large open area, coarse cobble gravel exposed at surface with concrete rubble and brick very commonly exposed. Fill slope along Ley Creek exposes brick and concrete. Localized standing water common, one small surface swale with minor southward flow. pH - 7.4, SC - 390. Area vegetated with grasses, golden rod, and "reed grass" in low areas.

2.9 Drainage swale draining along highway. pH - 6.9, SC - 5,200.

2.10 Ley Creek. pH - 6.7, SC - 850. Approximate location of of relocated I-81.

2.11 3 foot wave cut exposure with gray-brown marl overlying organic-rich sand.

2.12 2 foot wave cut exposure of gray-brown silty sand overlying fossil hash.

2.13 Area overgrown with "reed grass", very numerous piles of demolition debris.

9.18 Drainage culvert 1 gpm, pH - 7.9, SC - 630.

9.19 Area covered with thick growth of "reed grass".

9.20 Excavation in beach 0-4 in., peat 4-8 in. marl with shells and concretions.

9.21 Pleasant Beach.

9.22 Excavation in beach, 0-4 in. marl with shells.

9.23 Spring discharging to pond, flow estimated @ 5 gpm, pH - 7.1, SC - 1780 (values measured December 1987)

9.24 Ponds frozen over December 8, 1987, drainage to the northwest.